

What is Claimed is:

1. A novel transition metal compound represented by the following general formula (1):

5 $(C_5R^1R^2R^3R^4R^5)(C_5R^6R^7R^8R^9R^{10})(C_5R^{11}R^{12}R^{13}R^{14}R^{15})M^1H$ --- Formula (1),

wherein $C_5R^1R^2R^3R^4R^5$, $C_5R^6R^7R^8R^9R^{10}$ and $C_5R^{11}R^{12}R^{13}R^{14}R^{15}$ denote cyclopentadienyl groups or substituted cyclopentadienyl groups, respectively;

$R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}$ and R^{15} are any one of hydrogen atom, hydrocarbon groups each having 1 to 30 carbon atoms
10 or organosilicon groups each having a substituent of hydrocarbon having 1 to 30 carbon atoms, which are the same or different from one another;

among them, R^1, R^2, R^3, R^4, R^5 , or $R^6, R^7, R^8, R^9, R^{10}$, or $R^{11}, R^{12}, R^{13},$ —
 R^{14}, R^{15} can be bonded to one another forming a cyclic hydrocarbon group (including polycyclic structure);

15 provided that at least one of $R^1, R^2, R^3, R^4, R^5, R^6, R^7, R^8, R^9, R^{10}, R^{11}, R^{12}, R^{13}, R^{14}$ and R^{15} is a substituent group other than hydrogen atom; and M^1 denotes a transition metal of group 4 of the periodic table.

2. The transition metal compound represented by the following general formula (2) as claimed in Claim 1:



--- Formula (2),

5 wherein $C_5R^{16}R^{17}R^{18}R^{19}R^{20}$, $C_5R^{21}R^{22}R^{23}R^{24}R^{25}$ and $C_5H_2R^{26}R^{27}R^{28}$ denote cyclopentadienyl groups or substituted cyclopentadienyl groups, respectively;

R^{16} , R^{17} , R^{18} , R^{19} , R^{20} , R^{21} , R^{22} , R^{23} , R^{24} , R^{25} , R^{26} , R^{27} and R^{28} are any one of hydrogen atom, hydrocarbon groups each having 1 to 30 carbon atoms
10 or organosilicon groups each having a substituent of hydrocarbon having 1 to 30 carbon atoms, which are the same or different from one another;

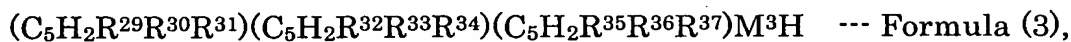
among them, R^{16} , R^{17} , R^{18} , R^{19} , R^{20} , or R^{21} , R^{22} , R^{23} , R^{24} , R^{25} , or R^{26} , R^{27} , R^{28} can be bonded to one another forming a cyclic hydrocarbon group (including polycyclic structure);

15 provided that at least one of R^{16} , R^{17} , R^{18} , R^{19} , R^{20} , R^{21} , R^{22} , R^{23} , R^{24} , R^{25} , R^{26} , R^{27} and R^{28} is a substituent group other than hydrogen atom; and

M^2 denotes a transition metal of group 4 of the periodic table.

3. The transition metal compound as claimed in Claim 2, wherein
20 R^{26} , R^{27} and R^{28} are bonded to adjacent carbons at the 1-position, 2-position and 3-position.

4. The transition metal compound represented by the following general formula (3) as claimed in Claim 1:



wherein $(C_5H_2R^{29}R^{30}R^{31})$, $(C_5H_2R^{32}R^{33}R^{34})$ and $(C_5H_2R^{35}R^{36}R^{37})$ denote
5 cyclopentadienyl groups or substituted cyclopentadienyl groups, respectively;

R^{29} , R^{30} , R^{31} , R^{32} , R^{33} , R^{34} , R^{35} , R^{36} and R^{37} are any one of hydrogen atom, hydrocarbon groups each having 1 to 30 carbon atoms or organosilicon groups having a substituent of hydrocarbon having 1 to 30 carbon atoms, which are the same or different from one another,

10 among them, R^{29} , R^{30} , R^{31} , or R^{32} , R^{33} , R^{34} , or R^{35} , R^{36} , R^{37} can be bonded to one another forming a cyclic hydrocarbon group (including polycyclic structure); provided that at least one of R^{29} , R^{30} , R^{31} , R^{32} , R^{33} , R^{34} , R^{35} , R^{36} and R^{37} is a substituent group other than hydrogen atom; and

M^3 denotes a transition metal of group 4 of the periodic table.

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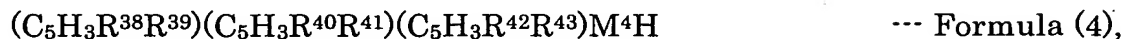
5. The transition metal compound as claimed in Claim 4, wherein R^{29} , R^{30} , R^{31} ; or R^{32} , R^{33} , R^{34} , or R^{35} , R^{36} , R^{37} are bonded to adjacent carbon atoms at 1-position, 2-position and 3-position of the respective cyclopentadienyl group.

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6. The transition metal compound as claimed in Claim 5, wherein the three substituted cyclopentadienyl groups of $(C_5H_2R^{29}R^{30}R^{31})$, $(C_5H_2R^{32}R^{33}R^{34})$ and $(C_5H_2R^{35}R^{36}R^{37})$ are the same in structure.

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7. The transition metal compound represented by the following general formula (4) as claimed in Claim 1:



wherein $(C_5H_3R^{38}R^{39})$, $(C_5H_3R^{40}R^{41})$ and $(C_5H_3R^{42}R^{43})$ denote cyclopentadienyl groups or substituted cyclopentadienyl groups, respectively;

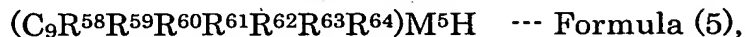
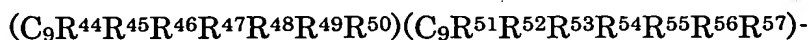
R^{38} , R^{39} , R^{40} , R^{41} , R^{42} and R^{43} are any one of hydrogen atom, hydrocarbon groups each having 1 to 30 carbon atoms or organosilicon groups each having a substituent of hydrocarbon having 1 to 30 carbon atoms, which are the same or different from one another;

among them, R^{38} , R^{39} or R^{40} , R^{41} or R^{42} , R^{43} can be bonded to one another forming a cyclic hydrocarbon group (including polycyclic structure);

provided that at least one of R^{38} , R^{39} , R^{40} , R^{41} , R^{42} and R^{43} is a substituent group other than hydrogen atom; and M^4 denotes a transition metal of group 4 of the periodic table.

8. The transition metal compound as claimed in Claim 7, wherein the three substituted cyclopentadienyl groups of $(C_5H_3R^{38}R^{39})$, $(C_5H_3R^{40}R^{41})$ and $(C_5H_3R^{42}R^{43})$ are the same in structures.

9. The transition metal compound represented by the following general formula (5) as claimed in Claim 1:



5 wherein $(\text{C}_9\text{R}^{44}\text{R}^{45}\text{R}^{46}\text{R}^{47}\text{R}^{48}\text{R}^{49}\text{R}^{50})$, $(\text{C}_9\text{R}^{51}\text{R}^{52}\text{R}^{53}\text{R}^{54}\text{R}^{55}\text{R}^{56}\text{R}^{57})$ and $(\text{C}_9\text{R}^{58}\text{R}^{59}\text{R}^{60}\text{R}^{61}\text{R}^{62}\text{R}^{63}\text{R}^{64})$ denote indenyl groups or substituted indenyl groups, respectively;

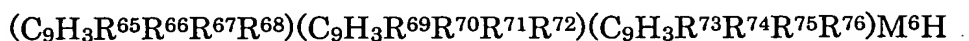
10 R^{44} to R^{64} are any one of hydrogen atom, hydrocarbon groups each having 1 to 30 carbon atoms or organosilicon groups each having a substituent of hydrocarbon having 1 to 30 carbon atoms, which are the same or different from one another,

among them, R^{44} to R^{50} or R^{51} to R^{57} or R^{58} to R^{64} can be bonded to one another forming a cyclic hydrocarbon group (including polycyclic structure);

15 provided that at least one of R^{38} , R^{39} , R^{40} , R^{41} , R^{42} and R^{43} is a — substituent group other than hydrogen atom; and

M^5 denotes a transition metal of group 4 of the periodic table.

10. The transition metal compound represented by the following general formula (6) as claimed in Claim 1:



--- Formula (6),

5 wherein $(C_9H_3R^{65}R^{66}R^{67}R^{68})$, $(C_9H_3R^{69}R^{70}R^{71}R^{72})$ and $(C_9H_3R^{73}R^{74}R^{75}R^{76})$ denote indenyl groups or substituted indenyl groups, respectively;

R^{65} to R^{76} are any one of hydrogen atom, hydrocarbon groups each having 1 to 30 carbon atoms or organosilicon groups each having a
10 substituent of hydrocarbon having 1 to 30 carbon atoms, which are the same or different from one another;

among them, R^{65} to R^{68} , R^{69} to R^{72} and R^{73} to R^{76} can be bonded to carbon atoms of 4-position, 5-position, 6-position and 7-position, respectively, of indenyl groups (in the part of six-membered ring) and they can be bonded
15 to one another forming cyclic hydrocarbon groups (including polycyclic structure);

M^6 denotes a transition metal of group 4 of the periodic table.

11. The transition metal compound as claimed in Claim 10, wherein
20 the three substituted indenyl groups of $(C_9H_3R^{65}R^{66}R^{67}R^{68})$, $(C_9H_3R^{69}R^{70}R^{71}R^{72})$ and $(C_9H_3R^{73}R^{74}R^{75}R^{76})$ are the same in structure.

12. The transition metal compound as claimed in any one of Claim 1 to Claim 10, wherein the transition metal of group 4 of the periodic table is Zr.

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13. A catalyst for olefin polymerization, which comprises any one of the transition metal compounds as claimed in any one of Claim 1 to 11, an organoaluminum oxy compound and/or a compound which can form ion pairs with the transition metal compound.

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14. The catalyst for olefin polymerization as claimed in Claim 13, wherein the organoaluminum oxy compound is methyl aluminoxane.

15. A solid catalyst for olefin polymerization, wherein the catalyst as
5 claimed in Claim 13 or Claim 14 is supported on a carrier.

16. A solid catalyst for olefin polymerization, wherein any one of the transition metal compounds as claimed in Claim 1 to 12 is supported on layered silicate.

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17. A method for producing polyolefin, wherein olefin is polymerized under the existence of any one of the catalysts as claimed in Claims 13 to 16.

18. The method for producing polyolefin as claimed in Claim 17,
15 wherein the olefin polymerization is homopolymerization of ethylene or copolymerization of ethylene and α -olefin.